

A descriptive survey of tracheal extubation practices among Indian anaesthesiologists

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ABSTRACT

Background and Aims: This study assesses the extubation practices of anaesthesiologists and whether these practices differ from existing guidelines. **Methods:** The literature related to tracheal extubation was searched and a validated questionnaire was designed to assess practices of tracheal extubation. The questionnaire included techniques, manoeuvres, preparation, timing and plan of extubation. The survey link was shared with eligible participants. The responses were assessed using Statistical Package for Social Sciences (SPSS) software. **Results:** Of the 1264 respondents, 66.8% keep difficult airway cart ready only when difficult extubation is anticipated. Only 12.3% of respondents perform deep extubation with supraglottic airway device (SAD) exchange while 73.3% of respondents perform awake extubation with pharmacological control for preventing haemodynamic fluctuations. In the case of anticipated difficult extubation, 48.3% anaesthesiologists prefer the airway exchange catheter (AEC) exchange technique. Of all, 84.8% anaesthesiologists administer 100% oxygen before performing extubation and 81.7% continue to oxygenate during and 83.9% provide oxygen after extubation in all patients. In the case of suspected airway edema or collapse or surgical cause for airway compromise, 70% anaesthesiologists perform a leak test. The most preferred plan of extubation in patients with suspected airway collapse after surgery is direct extubation in fully awake position (54.6%). In patients with anticipated difficult extubation, 50.8% anaesthesiologists prefer to ventilate for 24 hours and reassess. **Conclusion:** We observed that the extubation practices vary widely among anaesthesiologists. Almost half of the anaesthesiologists were unaware of extubation guidelines.

Key words: Difficult airway, difficult extubation, difficult intubation, extubation, surgical airway

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INTRODUCTION

Tracheal extubation after completion of surgery is an important aspect of perioperative care for uneventful patient recovery. Tracheal intubation has always been given much emphasis, but extubation remains an ignored aspect in literature and clinical practice. Adverse events related to extubation include airway obstruction, laryngospasm, bronchospasm, aspiration, airway edema and so on which may lead to emergency reintubation. These events increase the risk of morbidity and mortality. Proper planning and its execution before extubation are of utmost importance, especially in the difficult airway. Various guidelines have been formulated to provide a structured approach and proper technique for extubation.^[1,2] The knowledge and practice of these guidelines are important to optimise extubation

practices for different scenarios to improve patient outcomes and minimise postoperative complications.

We designed a survey to assess the extubation practices among anaesthesiologists with regards to techniques, manoeuvres, timing, and plan of extubation in various situations and whether there were any differences in their practices from the existing guidelines.

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METHODS

The literature related to tracheal extubation was searched in various databases including Pubmed/Medline, Cochrane, Scopus and Google Scholar. The existing difficult airway guidelines by All India Difficult Airway Association (AIDAA) and Difficult Airway Society (DAS) were also referred.^[1,2] The keywords 'difficult airway', 'extubation', 'difficult intubation', 'difficult extubation', 'extubation and surgical airway', 'extubation and haemodynamics' in various combinations were used for literature search. The bibliography of the retrieved manuscripts was searched manually for any missing manuscripts.

Based on this literature, a questionnaire was designed to cover various aspects related to tracheal extubation. The questionnaire was designed as per the format for the online (web-based) survey.^[3,4] A total of 25 questions were designed in the English language and all of them were closed-ended questions (multiple-choice or checkbox) except one open-ended question at the end of the survey. The questionnaire collected data about the experience and working place of anaesthesiologists, their techniques, manoeuvres, preparation, timing, and plan of extubation in various scenarios. The questionnaire was reviewed by 5 independent experienced anaesthesiologists (with experience of >10 years) and comments related to ambiguity, clarity, and relevance were sought. The questionnaire was revised accordingly as per the comments. In case of a difference in opinion among these, the consensus was achieved among the three researchers for the final survey question. The final survey was also shared with non-anaesthesiologists and three other experienced anaesthesiologists for a final review. The comments were requested about any ambiguity in words, language and understanding. The final revision of the questionnaire was thus made for its distribution.

The google form-based questionnaire was made and its web-based link was shared via e-mail and WhatsApp among anaesthesiologists working in India. One anaesthesiologist could participate once in the survey. Only anaesthesiologists who have completed their post-graduation in anaesthesia were included. The response was voluntary, and the anonymity of the participants was maintained. Their responses were recorded and assessed using Statistical Package for the Social Sciences (SPSS) software. The data collected about practice patterns were analysed using descriptive analysis.

RESULTS

We analysed the responses from 1264 respondents. Majority of the respondents (45.6%) had experience of more than 10 years and 55.2% were from the academic institutes [Table 1].

According to the data collected, it was observed that 66.8% of respondents keep difficult airway cart ready only when difficult extubation is anticipated while 30.4% keep difficult airway cart ready for all patients. In case of low risk for extubation (normal airway and intubation), where pharmacological control of haemodynamic parameters is required, only 12.3% of respondents perform deep extubation with supraglottic airway device (SAD) exchange, 73.3% of respondents perform awake extubation with pharmacological control for preventing haemodynamic fluctuations, and 14.4% perform direct extubation in a patient with low risk of extubation failure. During extubation in a deep plane of anaesthesia, the most common technique used was direct extubation followed by mask ventilation [Table 2]. In the case of anticipated difficult extubation, the majority (48.3%) anaesthesiologists prefer the airway exchange catheter (AEC) exchange technique for extubation [Table 2]. Most of the anaesthesiologists (60.3%) keep AEC for <2 h and few keep it for 2-12 h in situ. Very few (4.6%) keep it for >12 h.

Regarding oxygen supplementation, 84.8% anaesthesiologists administer 100% oxygen in all patients before performing extubation, 81.7% continue to oxygenate during the extubation process, and 83.9% provide oxygen after extubation in all patients [Table 3]. A time-based (for a fixed period) technique is most commonly used for delivery of 100% oxygen before performing extubation [Table 3].

The routine use of recruitment maneuvers before extubation was low and 54.7% of anaesthesiologists apply positive pressure in all patients during the

Table 1: Demographic profile of the respondents (n=1264)

Parameter	Options	Response n (%)
Experience in Anaesthesiology (after completing post-graduation)	<3 years	265 (21.1%)
	3-5 years	214 (16.9%)
	6-10 years	208 (16.4%)
	>10 years	577 (45.6%)
Workplace	Academic Institute	698 (55.2%)
	Corporate Hospital	318 (25.2%)
	Freelance practice	207 (16.4%)
	Others	41 (3.2%)

Table 2: Use of various techniques for difficult extubation (n=1264)

Parameter	Options	Response n (%)
Which technique do you perform for airway management during extubation in deep anaesthesia?	Supraglottic airway device (SAD) exchange (Bailey manoeuvre)	340 (26.9%)
	Direct extubation followed by mask ventilation	742 (58.7%)
	Extubation over airway exchange catheter	128 (10.1%)
	Other	54 (4.3%)
In case of anticipated difficult extubation, which advanced technique do you prefer for awake extubation?	Airway Exchange Catheter (AEC)	611 (48.3%)
	Laryngeal mask airway exchange/Bailey manoeuvre	289 (22.9%)
	Fiberoptic bronchoscope/Video endoscope exchange	120 (9.5%)
	Direct Extubation	243 (19.2%)
	Other	1 (0.1%)

Table 3: Peri-extubation oxygen supplementation (n=1264)

Parameter	Options	Response n (%)
Do you administer 100% oxygen before performing awake extubation?	All patients	1072 (84.8%)
	Selected patients (e.g.in anticipated difficult extubation)	154 (12.2%)
	Administer the same % of oxygen as intraoperatively	38 (3%)
Do you continue to oxygenate with 100% oxygen at the extubation process?	Yes	1032 (81.7%)
	No	88 (7%)
	Selected patients (e.g.in anticipated difficult extubation)	144 (11.4%)
Do you routinely provide oxygen supplementation after extubation?	Yes	1060 (83.9%)
	No	86 (6.8%)
	Selected patients (e.g.in anticipated difficult Extubation)	118 (9.3%)
Which technique do you use for delivery of 100% oxygen before performing extubation?	Time-based -for a fixed period (e.g., 1,2,3 minutes)	792 (62.6%)
	End-tidal oxygen (EtO ₂) monitoring based	423 (33.5%)
	Other	49 (3.9%)

extubation process [Table 4]. The survey revealed that 62% of anaesthesiologists suppress haemodynamic responses in selected patients with normal airway and 8.3% suppress in the difficult airway. In the case of suspected airway edema or collapse or surgical cause for airway compromise, 70% anaesthesiologists perform a leak test and 17% were not sure. The qualitative method is used by most of them (47%) for the leak test.

The most preferred plan of extubation in patients with suspected airway collapse after surgery is direct extubation in a fully awake position (54.6%). In patients with anticipated difficult extubation (difficult mask ventilation/difficult intubation, delayed recovery because of pre-existing diseases), 50.8% anaesthesiologists prefer to ventilate for 24 hours and reassess [Table 5]. In difficult extubation cases with surgical cause for airway compromise/suspected airway edema/collapse, 65.2% prefer to ventilate for 24 hours [Table 5]. In case of high suspicion of airway edema, manoeuvre or drugs used before extubation were steroids (48%), nebulised epinephrine (28%), and head-up position (23%). Among the participants, 37.6% follow DAS guidelines, 19.8% follow AIDAA guidelines whereas 42.6% follow department protocol-based algorithms for extubation. As far

as awareness of the difficult airway algorithm is concerned, 44% of anaesthesiologists were unaware of the extubation guidelines/algorithms. Various suggestions were invited to improve airway algorithms. Some of them were the inclusion of obstetric and paediatric extubation in difficult airway algorithms.

DISCUSSION

This survey focused on various practice patterns related to extubation planning, extubation techniques, and awareness of the extubation algorithm among anaesthesiologists. There is a scarcity of such information from anaesthesiologists. The reported data related to knowledge and awareness of extubation practices have not focused on techniques and plans of extubation.^[5,6]

According to the data collected from all anaesthesiologists, it was observed that 66.8% of respondents keep difficult airway cart ready only when difficult extubation is anticipated while 30.4% of people keep difficult airway cart ready always in all patients.

We observed that the availability of difficult airway cart was not universal even when difficult extubation

Table 4: Use of recruitment manoeuvre and positive pressure for extubation (n=1264)

Parameter	Options	Response n (%)
Do you perform a recruitment manoeuvre (if not contraindicated) before extubation?	All patients	321 (25.4%)
	Selected patients (e.g. in anticipated difficult extubation)	541 (42.9%)
	Do not perform	402 (31.8%)
Do you apply positive pressure during the extubation process (endotracheal tube removal)?	All patients	691 (54.7%)
	Selected patients (e.g. in anticipated difficult extubation)	278 (22%)
	Don't apply	295 (23.3%)

Table 5: Extubation strategies in difficult extubation (n=1264)

Parameter	Options	Response
What is your preferred plan of extubation in patients with suspected airway collapse (leak absent/equivocal) after surgery?	Extubate under deep inhalational anaesthesia directly	28 (2.2%)
	Extubate under deep inhalational anaesthesia over AEC/FOB	430 (34%)
	Direct extubation in fully awake and observe	690 (54.6%)
	Tracheostomy	116 (9.2%)
What is the plan for extubation in difficult extubation cases with difficult mask ventilation/Difficult intubation/Delayed recovery/difficulty because of pre-existing disease?	Upfront tracheostomy	88 (7%)
	Extubate over Airway Exchange Catheter (AEC)/Fiberoptic bronchoscope (FOB)	471 (37.3%)
	Ventilation for 24 h and reassess	643 (50.8%)
	Other	62 (4.9%)
What is the plan for extubation in difficult extubation cases with surgical cause for airway compromise/suspected airway edema/suspected airway collapse?	Upfront tracheostomy	215 (17%)
	Extubate over AEC/FOB	192 (15.2%)
	Ventilation for 24 Hours and reassess	824 (65.2%)
	Other	33 (2.6%)

is anticipated. Although ready access to alternative airway devices reduces risk and complications in the unanticipated difficult airway, according to guidelines difficult airway cart should be readily available in case of anticipated difficult extubation.^[1,2,5,6]

In patients who require obtundation of haemodynamic responses like ocular, intracranial surgeries, etc., most of the anaesthesiologists (73%) prefer to do awake extubation with pharmacological control while only 12% prefer deep extubation. Both are the techniques described in low-risk algorithms of airway guidelines.^[1,2] But most anaesthesiologists do not prefer deep extubation which may either be because of lack of expertise or lack of regular practice. Although deep extubation has many advantages e.g., decreased cardiovascular sympathetic stimulation, lesser incidence of cough, and laryngospasm, there is an increased incidence of respiratory complications after extubation under deep anaesthesia.^[7,8] The anticipated respiratory complications may be one of the reasons for low rates of deep extubation.

In case of anticipated difficult extubation, AEC is the most preferred advanced technique followed by laryngeal mask airway (LMA) exchange (Bailey's manoeuvre) followed by direct extubation. AEC use has been supported by various airway guidelines and the evidence of successful reintubation through AEC

is also sufficient.^[1,2,5,9,10] LMA exchange is the first and most useful advanced technique described in DAS as well as AIDAA guidelines.^[1,2] The safety and efficacy of this technique are well described in the literature.^[11,12] A fiberoptic bronchoscope (FOB) is the least preferred technique for extubation in anticipated difficult extubation in our survey. This finding is also supported by a recent survey in the Indian scenario and most likely due to lack of expertise and less availability.^[13] FOB may be of limited use because of its inherent limitation when used as an exchange catheter due to its stabilisation, expense, and risk of its breakage. It is also limited in its ability to oxygenate and monitor capnography through it because of its small lumen.^[14] That may be the reason for not preferring FOB for difficult extubation. The AEC can be retained up to 72 hours as described in the literature.^[5,6,12] However, the timing of retaining AEC should be individualised. In our survey, 60.4% of anaesthesiologists prefer to keep it *in situ* for <2 hours and 19% prefer to keep it from 2-12 hrs.

As far as oxygenation is concerned, 84% anaesthesiologists administer 100% oxygen before performing extubation in all patients and 82% continue to oxygenate throughout the extubation process and after extubation too. Extubation guidelines recommend providing preoxygenation with an inspired fraction of oxygen (FiO₂) 1 to build oxygen stores to provide

safe apnea time.^[1,2,5,6] Although studies show that 100% oxygen increases the chances of atelectasis, the clinical significance is controversial.^[15,16] During extubation, improving oxygen reserve takes a priority. To assess the delivery of oxygen before performing extubation, a time-based technique is most commonly employed (63%) in this survey followed by end-tidal oxygen (EtO₂) monitoring (33%). Although EtO₂ >90% is a better endpoint for the adequacy of oxygenation than a fixed period, its lesser utilisation maybe because of lack of availability and unfamiliarity of the technique and high cost associated with the technology.^[1,2,16] AIDAA and DAS recommend applying recruitment manoeuvre (if not contraindicated) and positive pressure before extubation. However, only 43% of anaesthesiologists perform recruitment manoeuvres in selected patients and 55% apply positive pressure in all patients. Although reports of recruitment manoeuvre and positive pressure in the prevention of atelectasis have contradicting results, still guidelines have emphasised its importance in pre-extubation period.^[17-20]

Haemodynamic responses secondary to extubation need to be obtunded and pharmacological measures like opioids are usually used. However, it can lead to sedation and respiratory depression post-extubation. Therefore, it should be done cautiously. AIDAA recommends haemodynamic suppression to be mandatory in the normal airway in a selected group of patients undergoing eye surgeries, vascular surgeries, intracranial surgeries, or thoracic surgical procedures in whom awake extubation is to be performed.^[1] Only, 61% of anaesthesiologists perform haemodynamic suppression in the normal airway in a selected group of patients and 19% in all patients. The extubation failure may be seen in the difficult airway due to surgical cause (structural damage or nerve injury) or there is suspicion of postoperative airway edema or collapse (e.g., long-standing thyroid tumors, swelling, or another neck mass excision, obese patients or airway-related surgeries). A leak test is recommended in this group of patients to assess airway calibre and collapsibility.^[1,21,22] In the present survey, 70% anaesthesiologists always perform, and 18% anaesthesiologists probably perform leak tests in such cases of suspected airway compromise. We observed that 47.5% prefer to perform qualitative tests and 33% prefer quantitative tests. Although the quantitative test is more accurate in identifying cuff leak, it is still not practised much probably because of the lack of proper techniques or lack of knowledge.^[23,24] In patients with negative or equivocal leak test (suspected

airway collapse), 55% anaesthesiologists prefer extubation when fully awake followed by extubation in deep inhalational anaesthesia over AEC/FOB (34%) followed by tracheostomy (9%). Both the techniques (awake as well as deep inhalational over AEC/FOB) have been described in AIDAA guidelines^[1] whereas DAS guidelines^[2] do not specify the technique for this specific group of patients, rather they have grouped such patients in 'at-risk group' for which awake extubation or advanced techniques are advised if it is safe to remove the tube. American Society of Anesthesiologists (ASA) taskforce recommends consideration of merits and demerits of deep extubation versus awake extubation in the difficult airway.^[9] Deep extubation has been advocated to decrease the occurrence of coughing and laryngospasm. However, it may be associated with the risk of airway obstruction due to the decreased tone of the pharyngeal muscle.^[25] Difficulty airway has been reported as one of the contraindications for deep extubation and thus avoided and awake extubation remains the preferred technique.^[26,27] In difficult extubation cases with difficult mask ventilation/difficult intubation/delayed recovery/difficulty because of preexisting disease, 51% anaesthesiologists prefer delaying extubation and ventilate for 24 hours and reassess; 37.3% prefer to extubate over AEC/FOB and 6.7% prefer upfront tracheostomy. Even in patients with surgical cause for airway compromise, suspected airway edema, and collapse, 65.1% anaesthesiologists prefer to ventilate for 24 hours and reassess followed by 17% preferring upfront tracheostomy and 15.2% preferring extubation over AEC/FOB. Keeping asleep and intubated in the postoperative period and transfer to a critical care unit appears to be the safest option in anticipated difficult extubation cases provided proper precautionary measures are taken during transfer.^[5,6,9] This is the most preferred option in our survey too. In case of high suspicion of airway edema, management options include head-up position, steroids, and nebulised epinephrine.^[28-30] The most common method employed in our survey is steroids (48%) followed by nebulised epinephrine (28%) and head-up position (23%). Most of the anaesthesiologists may be using all simultaneously but steroids seem to be the first choice for airway edema.

Most of the anaesthesiologists follow departmental protocol-based algorithms for extubation (43%) followed by DAS (38%) and AIDAA guidelines (19.7%). It was observed that 44% of anaesthesiologists are unaware of the presence of extubation guidelines.

This depicts the need of improving awareness about the extubation guidelines to promote uniform and safe extubation practices. Some contraries to the present guidelines were also depicted in this survey. Aintree catheter guided extubation needs to be added to AIDAA guidelines. In case of the decision to delay extubation, extubation time may be shorter also (6-8 h) rather than 24 hr.

To conclude, we observed that the availability of difficult airway carts at extubation is not universal, the use of the pharmacological technique is a commoner technique to obtund haemodynamic response at extubation. The use of AEC is seen in half of the anaesthesiologists in anticipated difficult extubation. The majority provide 100% oxygen supplementation in the perioperative period. Almost half of the anaesthesiologists were unaware of extubation guidelines.

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Conflicts of interest

There are no conflicts of interest.

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